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for

RAILROAD PANEL PLACEMENT SYSTEM

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RAILROAD PANEL PLACEMENT SYSTEM

BACKGROUND OF THE INVENTION

1. The Field of the Invention

[001] Exemplary embodiments of the present invention relate to the laying or repairing of railroad tracks, and, more specifically, to a system for moving and placing railroad panels.

2. The Relevant Technology

[002] Railroads and rail systems have existed since the middle of the nineteenth century. In a typical rail system, rail cars move along a pair of steel rails that are evenly spaced apart. These rails are secured to wooden ties that are laid in a bed of gravel or some other stabilizing material. This system of rails and ties is known as a railroad track.

[003] Railroad tracks were originally laid down by a group of workers. The workers would manually set each individual tie on the rail bed. Once a sufficient number of ties had been laid, the workers would manually secure the steel rails to the ties. This was done by hammering large spikes into the ties at spaced apart intervals to hold down the rails. The process was very labor intensive, and potentially very dangerous. The ties and rails were quite heavy, and there was always the potential to drop one or both on, for example, a workers foot.

[004] By the 1950's, railroad operators had devised a better system for laying and/or repairing railroad tracks. The operators started using rail panels to lay or repair track. A rail panel is made up of a pair of evenly spaced rails attached to a series of ties.

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In one standard configuration, the rail panel is 39 feet long and weighs approximately 10,000 pounds. The rails have joint bars on one end to allow the panel to be lined up with an existing section of track.

[005] Modern railroad operators typically use a panel grabber that picks up a panel as a unit. The panel grabber allows a panel to be placed in position without having to individually lay ties and rails. Typical panel grabbers have a pair of arms that resemble two large pairs of pliers spaced about three feet apart. These pliers-like arms fit over the outside of the rails. The arms must be manually locked in place on the panel. As a lifting force is applied, the arms grab the sides of the rails, thus allowing the panel to be moved.

[006] To use such typical panel grabbers, an individual must climb on top of a stack of panels to align the grabber. These stacks of panels are often delivered to a job site on the back of a flatbed truck. They can be stacked six or more high. Having been transported for potentially many miles, these stacks of panels may be unstable when tie downs securing the panels are released. An individual climbing on top of the panels must manually align the panel grabber, placing it very near the center of the panel, and then lock it in place. If the panel grabber is not placed near the center of the panel, it will lift only one end of the panel, causing the other end to tilt and/or drag. If it is not properly centered, the individual must climb back onto the stack of panels and manually attempt alignment a second time.

[007] With the typical system, individuals with guide ropes generally manually stabilize the 10,000 pound panels when the panel is lifted and suspended in the air. This prevents the panel from twisting or turning in undesired orientations. Unfortunately, it is a challenge for an individual, or even a group of individuals, to exert enough force on

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a 10,000 pound panel to stabilize it while it is suspended in the air. Additionally, other individuals must physically align the joint bars with the existing track. This system can require as many as six men to place one panel onto the rail bed.

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BRIEF SUMMARY OF THE EXEMPLARY EMBODIMENTS

[008] It would therefore be an improvement in the art to develop a system of lifting, moving, and placing rail panels that eliminates, as much a possible, the need for manual labor in the process. Exemplary embodiments of the inventive system described herein allow a heavy equipment operator to attach a lifting device, lift the panel, and accurately place the panel adjacent to currently installed track without having multiple personnel attempting to manually stabilize and align the panels.

[009] These and other objects and features of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

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BRIEF DESCRIPTION OF THE DRAWINGS

[010] To further clarify the above and other advantages and features of the present invention, a more particular description of the invention will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. It is appreciated that these drawings depict only typical embodiments of the invention and are therefore not to be considered limiting of its scope. The invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

[011] Figures 1A and 1B illustrate a top and end view, respectively, of an exemplary rail panel;

[012] Figure 2 illustrates a perspective view of a system for lifting and transporting a rail panel, the system comprising a rail panel grabber assembly, according to one aspect of the present invention;

[013] Figure 3 is a top plan view of a panel grabber assembly of Figure 2;

[014] Figures 4A and 4B are detailed cutaway side views of the panel grabber assembly of Figure 2 illustrating the mounting of the assembly on a rail panel and the operation of the hydraulic cylinder;

[015] Figure 5 illustrates a perspective view of the underside of the rail panel grabber assembly of Figure 2;

[016] Figure 6 is a top perspective view of the rail panel grabber assembly of Figure 2 showing a rotator and certain hydraulic lines;

[017] Figure 6a shows a perspective view of the rail panel grabber assembly of Figure 6 coupled to an excavator;

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[018] Figure 7 illustrates a perspective view of the rail panel grabber assembly of Figure 2 in an operational position mounted on a rail panel; and

[019] Figure 8 illustrates a perspective view of the system of Figure 2 with the rail panel grabber assembly and rail panel in an elevated position.

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DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[020] Reference will now be made to Figures 1-8 wherein like structures will be provided with like reference designations. It is to be understood that the figures are diagrammatic and schematic representations of an embodiment of the claimed invention, and are not to be construed as limiting the scope of the present invention in any way, nor are the figures necessarily drawn to scale.

[021] Figures 1A and 1B illustrate one exemplary rail panel 10. Rail panel 10 has a plurality of ties 12 supporting a left rail 14 and a right rail 16. In exemplary embodiments, rail panel 10 is approximately 39 feet long, approximately 8.5 feet wide, and weighs approximately 10,000 pounds. In some instances, a rail panel uses 24 ties, although rail panels can also use any number of ties or other connecting linkages. The distance D_1 between the inside vertical surfaces of rails 14, 16 is known as the gauge. It is set by various standards setting organizations around the world, and can be different in different countries. For example, in the U.S., the standard railroad gauge is 4 feet, 8.5 inches. However, this distance varies by country. Exemplary embodiments of the present invention can be specifically designed to work with any gauge track, whether currently in use somewhere in the world or later developed.

[022] With specific reference to Figure 1B, rails 14, 16 have a generally "I" shaped cross section that is slightly smaller on top that on bottom. A plurality of spikes 18 attaches rails 14, 16 to ties 12. Left rail 14 is composed of three parts, a head 20, a body 22, and a foot 24. Body 22 has an inside vertical surface 26. Head 20 has an inside lower surface 28. Similarly, right rail 16 is also composed of three parts, head 30, body 32 and foot 34. Body 32 has an inside vertical surface 36. Head 30 has an

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inside lower surface 38. These surfaces will be discussed in more detail below with reference to Figures 4A and 4B.

[023] Figures 2-8 illustrate one exemplary embodiment of a rail panel grabber assembly 100 according to one aspect of the present invention. With reference to Figure 2, rail panel grabber assembly 100 includes a panel grabber 102 linked to a rotator 202. Specific details of panel grabber 102 and rotator 202 will be discussed below. Rail panel grabber assembly 100 can be linked to a hydraulic excavator 106, which is an example of a piece of equipment capable of lifting rail panel assembly 100 when it is attached to a rail panel. Excavator 106 and assembly 100 collectively serve as an example of a system for lifting and transporting a rail panel.

[024] Excavator 106 can be any piece of equipment of sufficient size to manipulate rail panel grabber assembly 100 when it is holding rail panel 10. In exemplary embodiments, excavator 106 can have one or more quick couplers (not shown) to facilitate the easy coupling of the hydraulic lines that power rail grabber 102 and rotator 202. Such couplers are well known to those of skill in the art.

[025] With general reference to Figures 3-8, and specific reference to Figure 3, rail grabber 102 includes a frame 110. Frame 110 comprises first and second "H" beams 112, 114 spaced apart from each other. Linked between first and second "H" beams 112, 114 are first and second tubes 116, 118. In an exemplary embodiment, first and second tubes 116, 118 are perpendicular to first and second "H" beams 112, 114. However, those skilled in the art will realize that other angles are possible and are included within the scope of exemplary embodiments of the invention.

[026] To provide additional structural support to rotator 202, first and second tubes 116, 118 can have third and fourth tubes 120, 122 linked therebetween. In an

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exemplary embodiment, third and forth tubes 120, 122 are perpendicular to first and second tubes 116, 118. However, those skilled in the art will realize that other angles and structures are possible and are included within the scope of exemplary embodiments of the invention. In this exemplary embodiment, tubes 116, 118, 120, 122 define the perimeter of a rotator attachment area 202a on panel grabber 102. Finally, to provide additional structural support to "H" beams 112, 114, of frame 110, a first and second angle brace 124, 126 can be fixed to the outer portions of first and second "H" beams 112, 114.

[027] In exemplary embodiments, first and second "H" beams 112, 114, first, second, third, and fourth tubes 116, 118, 120, and 122, respectively, and first and second angle braces 124, 126 are made from metal. Specifically, by way of example and not limitation, these frame members can be made from iron, steel or various metal alloys known to those of skill in the art. In one exemplary embodiment (shown in Figure 5), first and second "H" beams measure 10 by 10 inches and comprise ½ inch thick top and bottom flanges 112a, 112b, 114a, 114b, respectively, with a 5/16 inch web 112c, 114c centered perpendicularly therebetween. Other dimensions and thicknesses are also possible. Additionally, other cross-sectional structures can be used to include, by way of example and not limitation, square, rectangular, circular, oval, or any other cross section capable of providing sufficient structural rigidity to support the weight of rail panel 10 while it is being manipulated by excavator 106.

[028] With continued reference to Figure 3, in exemplary embodiments, tubes 116, 118 comprise 6" wide by 10" tall tubes having a generally rectangular cross section and an approximately 3/8 inch wall thickness. Tubes 120, 122 comprise 5" by 5" square tubes having a wall thickness of approximately 3/8 inches. These dimensions

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are provided by way of example only. Those skilled in the art will realize that there are any number of different cross sectional areas, wall thicknesses, and other structures that can provide sufficient structural rigidity to support the weight of rail panel 10.

[029] With continued reference to Figures 3 and 5, each "H" beam 112, 114 further includes a plate 128, 130, respectively (shown in phantom in Figure 3), mounted towards the inside of the "H" beams 112, 114. Plate 128 is mounted on an inside of beam 112 between top flange 112a and bottom flange 112b. Plate 130 is mounted on an inside of beam 114 between top flange 114a and bottom flange 114b. Each plate 128, 130 includes an aperture 132, 134, respectively, that enables access to a hydraulic assembly 150, 152, respectively. Plates 128, 130 provide some protection for hydraulic assemblies 150, 152, which will be discussed in greater detail below. Apertures 132, 134 enable hydraulic lines to connect to hydraulic assemblies 150, 152, and enable convenient repair or replacement if necessary. The apertures also allow an operator to easily change the hydraulic lines feeding hydraulic assemblies 150, 152.

[030] With reference to Figures 4A, 4B and 5, "H" beam 112 includes stop plates 136a and 136b located on opposing ends. Beam 114 further includes stop plates 136c, 136d located on opposing ends. Each stop plate 136 forms an outside boundary of a respective notch 138a-138d in beams 112, 114. These notches 138a-d are designed to accommodate the width of, by way of example and not limitation, heads 20, 30 of rails 14, 16, respectively, shown in Figure 1. Additionally, the distance D_2 between notches 138 on each beam 112, 114 is generally the same as the distance D_1 (approximately the gauge) between rails 14, 16 in rail panel 10. The width of notches 138a-d and the distance D_2 between the notches on each of beams 112, 114 are precisely measured to correspond with the rail head width and gauge for the panels that rail panel grabber

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assembly 100 will move. These specific measurements are calibrated depending on the rail width and gauge desired. All rail head widths and gauges, wherever found in the world, are contemplated to fall within the scope of the exemplary embodiments of the present invention.

[031] Each stop plate 136a-d can be a metal plate approximately 2 inches thick. Stop plate 136a-d can be integral with or welded to respective beams 112, 114, and can be integral with or welded to first and second angle braces 124, 126, respectively. In one embodiment, each stop plate 136a-d can be welded to both the beams and the angle braces. The specific function of stop plates 136a-d will be discussed below.

[032] In exemplary embodiments, all of the components of frame 110 are welded together to form a rigid structure. However, other methods of joining such components are also contemplated, such as the use of mechanical fasteners or other methods, as long as the completed frame provides sufficient structural rigidity to allow panel grabber 102 to lock onto rail panel 10.

[033] In one exemplary embodiment, hydraulic assemblies 150, 152 are identical or substantially similar. However, any hydraulic assembly capable of generating the necessary force can be used in either "H" beam 112, 114. To avoid redundancy, the following discussion will focus on the structure of hydraulic assembly 150, keeping in mind that assembly 152 can have the same or similar structure. In those places where the specific structure of hydraulic assembly 152 is shown in the drawings, the letter designations "c" and "d" are used to label the parts that correspond to similar structure in hydraulic assembly 150.

[034] With continued reference to Figures 3, 4A and 4B, hydraulic assembly 150 includes a hydraulic cylinder 154. In an exemplary embodiment, hydraulic cylinder 154

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is not fixed within the passage defined by beam 114 and plate 130, but is free to move within the passage. Extending from hydraulic cylinder 154 is a pair of actuators 156a, 156b. Actuators 156a and 156b are connected to pins 158a and 158b, respectively. Each pin 158a 158b is constrained in a sliding relationship within a cylinder 160a, 160b. Within each cylinder 160a, 160b is a backstop 162a, 162b designed to prevent pins 158a, 158b from retracting too far towards hydraulic cylinder 154.

[035] In an exemplary embodiment, pins 160a, 160b are made from 2 3/8 inch diameter steel. Cylinders 160a, 160b are welded to frame 110 and can be made from 4.5 inch (outside) diameter steel having 1 inch thick walls, for example. In the embodiment, cylinders 160a, 160b are 13.5 inches long. Those skilled in the art will realize that other dimensions for pins 158a, 158b and cylinders 160a, 160b are also possible and are contemplated to fall within the scope of exemplary embodiments of the present invention.

[036] With specific reference to Figure 5, the underside of panel grabber 102 is shown. Hydraulic assembly 150 is visible through aperture 132 in plate 128. A pair of hydraulic lines 170, 172 powers hydraulic assemblies 150, 152. Line 170 is a high pressure line that actuates hydraulic assemblies 150, 152 to force pins 158a-d, into contact with the rails of rail panel 10 (see Figures 4A/4B). Line 172 is a high pressure line that actuates hydraulic assemblies 150, 152 to retract pins 158a-d, thus releasing rail panel 10 (see Figures 4A/4B). Additional details of the operation of rail panel grabber assembly 100 using hydraulic assemblies 150, 152 are discussed below.

[037] Having outlined the basic structure of panel grabber 102, a brief discussion of rotator 202 is in order. In exemplary embodiments, rotator 202 is a commercially available, hydraulically actuated rotator assembly. However, those skilled in the art

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will realize that there are many other rotator assemblies that could be used. Any assembly that is capable of rotating rail panel 10 when it is suspended by excavator 106 is contemplated to be within the scope of exemplary embodiments of the present invention.

[038] With reference to Figure 6, rotator 202 includes high pressure hoses 204, 206 that enable rotator 202 to rotate rail panel 10 in either direction. This rotation is accomplished using a hydraulically actuated rack and pinion gear, which is shown partially as reference numeral 210. Additionally, there is a third hose (not shown) associated with rotator 202 that allows hydraulic fluid to drain from a reservoir (not shown). A high pressure hose 208 feeds high pressure hose 170 (Figure 5) of panel grabber 102. Another high pressure hose (not shown) feeds high pressure hose 172 (Figure 5) of panel grabber 102.

[039] Rotator 202 can include a greater or lesser number of hydraulic hoses depending on the specific configuration of the rotator. For instance, in some embodiments, a drain hose is not required. In this exemplary embodiment, high pressure hoses 204, 206, and 208 are designed to use quick connectors for the connection to excavator 106. This allows the operator of excavator 106 to grab, pick up and manipulate rail panel 10 as needed or desired. However, any other method known to those of skill in the art for connecting the high pressure hoses to excavator 106 can also be used.

[040] Rotator 202 also includes a pair of cross beams 210, 212 that facilitate the mechanical connection of rotator 202 to a piece of heavy equipment, as shown in Figure 6a. For example, in one embodiment, excavator 106 has a mechanical linkage 107 that grasps both cross beams 210, 212. The mechanical linkage 107 may include, for

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example, a grabber coupler, such as an Esco Multi-Pin grabber coupler, which is available from Esco Corporation, Portland Oregon. One example of such a grabber coupler is Model # HTC 07102AL. Other pieces of heavy equipment can use the same or some other connection mechanism known in the art.

[041] Figures 4A, 4B, 7 and 8 illustrate the basic operation of rail panel grabber assembly 100. Figure 7 shows rail panel grabber assembly 100 in position on a rail panel 10. Panel grabber 102 is positioned on rails 14, 16 such that rails 14, 16 are engaged in respective slots 138a-d. The operator of excavator 106 can position rail panel grabber assembly 100 in this manner without any manual assistance. While rail panel 10 is shown positioned on the ground, this need not be the case. An operator of excavator 106 can position rail panel grabber assembly 100 on the top rail panel of a stack of rail panels sitting on a flatbed truck. The operator can then engage panel grabber 102, lift the top panel off of the truck, move it to wherever the panel is needed, and position the panel as desired. Additional help is not required.

[042] The specific functioning of hydraulic assemblies 150, 152 in the process outlined above will be discussed with reference to Figures 4A and 4B. Figure 4A shows a partial side view of part of panel grabber 102 in position above a rail 14. Note that pins 158a, 158b are in a retracted position as the panel grabber assembly is moved into position. In operation, all four pins will be positioned similarly, and discussion of the operation of a single pin, e.g. pin 158a, applies to all four pins 158a-d. Likewise, discussion of the operation of a single hydraulic assembly applies to the other hydraulic assembly.

[043] In one embodiment, shown by way of example only in Figure 4B, when the operator actuates hydraulic assemblies 150, 152, all of pins 158a-d extend at the same

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time. In this exemplary embodiment, a single high pressure hose 172 (Figure 5) activates hydraulic assemblies 150, 152 to simultaneously move all four pins 158a-d into the extended position. Likewise, high pressure hose 170 activates hydraulic assemblies 150, 152 to simultaneously retract all four pins 158a-d. While this need not be the case, it is preferred in one embodiment as an added safety measure. All four pins will either be engaged or disengaged simultaneously. The operator of excavator 106 need not worry about one side of panel grabber 102 engaging, while the other side does not.

[044] Figure 4B shows a partial side view of part of panel grabber 102 in an engaged position on top of rail 14. Note that pins 158a, 158b are now in an extended position, such that pin 158a contacts inside surface 26 of body 22 of rail 14, and abuts lower inside surface 28 of head 20. Sufficient pressure is applied to all four pins to firmly fix rail panel 10 to rail panel grabber assembly 100. Stop plates 136a-d on the outside of rails 14, 16 prevent pins 158a-d from bending or otherwise distorting the rails. The weight of rail panel 10 is thus supported by the four engaged pins 158a-d held securely in frame 110. While one exemplary embodiment has the pins 158a-d engaging an inside surface of the rails, a similar system can be used to engage the outside of the rails. Systems that use hydraulic pressure, and other systems used to grasp and firmly hold the rails, are considered to be within the scope of exemplary embodiments of the present invention.

[045] Figure 8 shows excavator 106 holding rail panel 10 in a raised position. While in this position, the operator can rotate, twist, turn and otherwise manipulate rail panel 10 using rotator 202. The operator can also drive from the pickup site to wherever the rail panel is needed. Note that no personnel other that the operator of

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excavator 106 need have any contact with rail panel 10 to initially pick and move rail panel 10. No guide lines are required. When the operator reaches his destination, the operator can place the panel in its operational position with only minor assistance from a single guide person. It should also be noted that the operator of excavator 106 need not pick up rail panel 10 in the exact center. Off center operation is easily accomplished using the procedure outlined above, since rail panel 100 is hydraulically coupled to rail panel 10.

[046] Rail panel grabber assembly 100 provides many advantages over the grabber of the prior art. First, the operator of excavator 106 can pick up the panels without assistance, while remaining safely within the cab of the excavator. It is not necessary to manually align the grabber and position it over the rails. Since exemplary embodiments of the present grabber fixedly couple to the rail panel, there is no need to specifically grab the panel in the center. This makes it even easier for the operator to grab and pick up panels unassisted. This also eliminates the need for guide ropes.

[047] Another advantage of the exemplary embodiments of the present invention is that multiple personnel are not required to place the panels in their operational position on a rail bed. An excavator operator skilled in his art can place the panels either unassisted, or with the help of a single guide who can provide visual directions to the operator to facilitate exact placement. Finally, exemplary embodiments of the present invention allow the rail panels to be lifted, transported and operationally placed much quicker than typical systems. For example, in accordance with one exemplary embodiment, the panels can be lifted off of the flatbed, moved to the rail bed, and positioned in about one fourth the time it would take to accomplish the same tasks using

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typical systems. Similarly, at the panel construction facility, the panels can be loaded onto the flatbed trucks much more quickly and safely.

[048] The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

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